

Promoting student learning by having college students participate in an online environment

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Abstract: Using data collected in spring 2009 from students at a southern research university enrolled in either of 2 sections of a general education course that fulfilled a social/behavioral sciences graduation requirement, the present study examined whether participating in online assignments enhanced students' satisfaction with those assignments and with their learning. Online assignments included chapter exams, video questions, and survey questions; they were due weekly. Additional online assignments were 2 threaded discussions over the semester. The study used subjective and objective measures of student learning. Overall results confirmed that having students participate in online assignments can promote student satisfaction and foster critical thinking and deep learning. Practice implications are briefly discussed.

Keywords: online assignments, general education course, student learning, student satisfaction

I. Introduction.

Student learning is a social construct that Schneider has argued is grounded in a 21st-century reinvention of the liberal educational ideal. That reinvented ideal calls for cultivating “intellectual judgment, social responsibility, and integrative learning” (2003, p. 3). Pursuing the ideal requires faculty to foster students’ analytical capability through work on their critical thinking, problem solving, and application skills; by involving students with people from various cultural backgrounds in intercultural and community contexts; and through creation of structured opportunities to integrate knowledge from numerous disciplines and link theory to practice (Schneider, 2003).

A general education course, Analysis of Social Problems, was completely redesigned, yielding a hybrid course in which both online resources and classroom-based collaborative learning activities were used to improve active learning and critical thinking (Garrison & Kanuka, 2004; Rovai & Jordan, 2004). In the hybrid course, moreover, emphasis was placed on learning processes as opposed to teaching processes; the learning environment was one in which evidence-based learning activities were used to move students gradually toward thinking critically (Bullen, 1998). Using data from students in two sections of the course in spring 2009, the present study examined whether and how online assignments given to these students were related to student learning. The study hypothesized that students’ regular participation in developing answers to questions and solutions to problems in an online environment would be associated with attitudes relatively favorable to the assignments, which in turn would improve student learning.

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Active learning refers to cultivation of knowledge via the learner's involvement in knowledge construction, within a learner-centered learning environment (Blumberg, 2009; Carlson & Schodt, 1995; Chermak & Weiss, 1999; Garfield, 1995; Karagiorgi & Symeou, 2005; Rockell, 2009). Knowledge obtained in this way is often called *deep learning* and includes both content mastery and skill development; normally it is more flexible and is retained longer than knowledge from *passive learning* or *surface learning*, both terms describing learning dependent on one-way passage of information from instructor to learner, the learner undertaking little processing of information offered (Jones, 2006).

Active learning clearly reflects Dewey's reflective thinking and interchangeable contemporary terminologies like critical thinking, problem solving, and high-order thinking (Samuel, 1999). Jacobs and colleagues define critical thinking as "the repeated examination of problems, questions, issues and situations by comparing, simplifying and synthesizing information in an analytical, deliberative, evaluative, decisive way" (Jacobs, Ott, Sullivan, Ulrich, & Short, 1997, p. 20). Grouping skills like problem solving, application, and integration under the umbrella of critical thinking, many researchers and educators argue the importance of sharpening students' thinking skills, such that critical thinking has become the primary goal for students in institutions of higher education (Anderson & Garrison, 1995).

Development of critical thinking can be pursued in various classroom or online settings, given the careful inclusion of social-environmental designs conducive to learning (Hannafin & Land, 1997). Today many students belong to the so-called Millennial generation. They are technologically savvy, are comfortable learning by trial and error, and want to stay "connected"; for them, computer-assisted assignments provide a reasonable context for learning (Meyer, 2003b; Oblinger, 2003; Rovai, 2004; Rovai & Jordan, 2004). Evaluating online learning environments in terms of their *cognitive presence*, *social presence*, and *teaching presence*, Garrison, Anderson, and Archer (2001) developed a conceptual model positing that deep, meaningful learning happens when the degree of each presence is sufficiently high. High cognitive presence can be achieved by having students (a) engage in reflective thinking and (b) make critical inquiries—via discussion with peers and teachers—in order to obtain meaning and construct knowledge (Garrison, et al., 2001). High social presence is indicated by a supportive learning environment in which all students are comfortable expressing their ideas. High teaching presence depends on the appropriate organization, structuring, and design of the learning environment to enhance student learning (Anderson, 2008).

In online settings, students, teachers, course designers, and computer technicians all contribute to the creation of the environmental conditions necessary for learning. Teachers, however, are arguably most responsible for building cognitive presence, social presence, and teaching presence into the learning environment (Barkley, Cross, & Major, 2005; Berling, 1998; Smith & MacGregor, 2000; Umbach & Wawrzynski, 2005). Results of several empirical studies have confirmed the relationships, in online settings, among these 3 presences and the development of critical thinking (Bullen, 1998; Garrison & Cleveland-Innes, 2005; Gunawardena & Zittle, 1997; Richardson & Swan, 2003; Rovai, 2004). Research has also documented that an online experience serves as a mediating factor in student satisfaction, channeling the effects of cognitive presence, social presence, and teaching presence on student learning (Arbaugh, 2001; Hiltx, 1993; Rodriguez, Plax, & Kearney, 1996).

The aim of the present study was to relate students' participation in online assignments to student satisfaction and student learning. With data from the students taking the redesigned, hybrid course, we could assess whether student learning increased when students participated in

online assignments designed to stimulate their construction of knowledge. The next section describes the hybrid course and details the online assignments used.

II. Research Context.

Taking a constructivist approach to learning and informed by the 21st-century notion of the liberal education ideal, we designed a hybrid version of a 200-level sociology course, Analysis of Social Problems, so that it was part traditional classroom, part online. This general education course was offered in spring 2009 at a southern research university and aimed to increase cognitive presence, teaching presence, and social presence in order to enhance learning. To produce the 3 presences, several steps were taken (Lo & Olin, 2009). Students were encouraged to take responsibility for learning, and the instructor assumed a role of teacher-facilitator (Association of American Colleges and Universities, 2002). Various learning and assessment methods were used, with both in-class and online activities used as vehicles of active and collaborative student learning. Assignments were framed to elicit critical thinking, including problem solving, application of knowledge, and integration of materials. The instructor encouraged shared, lateral communication among students, both in the classroom and outside it (Scarboro, 2004). The various outcome assessments for the course yielded results which encouraged confidence that, by semester's end, the students would gain both knowledge and the desired capacity for critical thinking.

The course blended the advantages of strictly online and strictly face-to-face learning, exploiting evidence-based pedagogical techniques to strengthen student learning (Spinello & Fischbach, 2008). The first of these techniques was minimization or actual elimination of formal lectures (Greek, 1995; Halpern & Hakel, 2003; Schneider & Shoenberg, 1998; Shen, Hiltz, & Bieber, 2008). The lectures dropped from the course syllabus were replaced with a lateral-exchange, question-and-answer format through which information could be shared among students and instructor. Students were assigned substantial responsibility for the learning process; they became real agents of learning, involved directly in the construction of knowledge (Cohen, Lotan, & Leechor, 1989; Rau & Heyl, 1990). The second evidence-based technique, meant to promote students' understanding of course materials, was the effective use of certain collaborative activities endorsed by the literature (Benbunan-Fich & Hiltz, 2003; Gokhale, 1995; Johnson, Johnson, & Smith, 1991; Jones, 2006; McKeachie, Pintrich, Lin, & Smith, 1986; Rau & Heyl, 1990).

The third technique was the development of questions and problems to assign as online work providing practice in the application of theories and concepts to new situations. These questions and problems were particularly carefully thought out; in writing corresponding answers and solutions, students needed to spend time reflecting, equipping themselves to assess evidence adequately, making inferences, and selecting appropriate strategies to apply (Bullen, 1998; Norris & Ennis, 1989).

The fourth technique comprised conveying clearly to the students the expectations about learning. Several channels were used: a detailed syllabus, well-defined purposes and procedures for classroom activities, a grading rubric for assignments, and frequent oral and online communication between students and instructor (Stevens & Levi, 2005; Suskie, 2004). The fifth technique was varying the course assignments and assessments, acknowledging students' various learning styles and backgrounds in order to more accurately measure their achievement (Crowe, Dirks, & Wenderoth, 2008). The sixth technique was making students accountable to themselves,

to the members of their activity groups, and finally to all enrolled students and the instructor herself, together as a class; this accountability was secured, in part, through students' participation in evaluations (Angelo & Cross, 1993; Halpern & Hakel, 2003; Nilson, 2003).

Again, all 6 techniques underpinned the redesigned Analysis of Social Problems course, which involved both online and in-class assignments and activities requiring collaboration with others as well as reflective thinking supporting the solution of problems, application of theories, and development of policy implications. The hybrid course was assigned 3 credit hours. Students met face-to-face once a week for 75 minutes, joining in group and class discussions. Except for these classroom activities, all work was completed via eLearning, the digital course management system supported by Blackboard that creates a virtual environment for teaching and learning in educational settings. In the group and class discussions and online assignments, students were asked to link principles from sociological theory (and empirical findings supporting those principles) to real-life developments in the profession, seeking solutions to problems of practice. They were also advised to show they could integrate theoretical principles and relevant sociological literature into any assignment completed for the course.

The course, again, was structured to create an environment promoting student-centered, active, and collaborative learning. It was also designed to focus on a single social problem each week. Each week, the group and class discussions were scheduled several days ahead of the due date for that week's 3 online assignments—a survey assignment, a video assignment, and a chapter exam. This schedule was meant to ensure that discussions would help students as they completed online assignments. The weekly survey assignment normally included reading an article from a well-known magazine (e.g., *New York Times Magazine*, *Newsweek*) and answering a question the instructor had derived from it. The video assignment was to answer a question posed by the instructor based on a video students viewed; answers were to be drawn from the video as well. Questions based on the articles and videos were structured to prompt students to apply a theory or theories to a new situation, stimulating their integration of text materials with information from the videos and articles. Finally, each week's chapter exam, taken online, contained multiple-choice questions drawn randomly from a pool of questions about the week's textbook chapter. Augmenting the weekly assignments, twice during the semester a discussion question was posed to students, who were asked to compose at least one response to this question and one response to a classmate's response. Both discussion questions concerned a controversial issue, and heated debates arose during those class meetings. Because the assignments and activities took such wide-ranging formats (anything from a multiple-choice test, to making the case for interpreting a news video via a given sociological theory), a variety of learning channels were available to the class, accommodating students' diverse thinking paths and learning styles.

From the first day of the course, the students had access to all of their online assignments except the discussion questions and final exam. (The due date of each online assignment was also posted.) Such availability gave students ample time to reflect on content, fostering development of critical thinking skills. The weekly chapter exams were time-limited; once beginning a chapter exam online, a student had 1 hour to complete it. Students were informed in advance that once the hour had elapsed, the software would prevent further responses or changes. They were advised to complete exams as quickly as possible. The multiple-choice exams were graded automatically once answers were submitted. Other online assignments were graded by two graduate students trained to use the grading rubric available to students in the course syllabus. The grading rubric established clearly for students the instructors' expectations for assignments. Grading reflected mastery of content and also, at several points in the term, the

adequacy of student writing (grammatical and mechanical errors). Grades were normally assigned within 1 week of an assignment's submission, and students could review online all grades received during the semester. When grading was complete for an online assignment, sample answers for it were provided to students. The weekly assignments constituted frequent computer-based assessments—formative feedback—that should have helped students improve academic performance (Ricketts & Wilks, 2002).

III. Methods.

The study sample was college students enrolled during spring 2009 in a hybrid (classroom plus online) sociology course at a research university, a course that emphasized active and collaborative learning about social problems. Data were collected with a survey instrument completed via eLearning; students' grades on weekly online assignments during the semester and on the comprehensive final exam constituted other study data. At the end of the course, students were asked to complete an eLearning instrument surveying their satisfaction with the course and their perceptions about whatever learning the course prompted. Using these data, we analyzed relationships between students' participation in online assignments and student learning. The university's institutional review board had approved the conduct of the study. [A complementary study examining impact of classroom activities on student learning has been reported elsewhere (Lo, in press).]

Over the semester, 10 of the 124 students initially registered for the course withdrew, leaving 114 students in the present sample; each of the 114 received a final course grade. Of the 114, 40% were male and 45% reported pursuing a major in one of the social sciences, with some studying criminal justice and psychology. Most commonly, a student in the course was a freshman (roughly 4 of 10, or 41%), though 18% were sophomores, 27% were juniors, and 13% were seniors. Our research design did not involve collecting any other pre-course measures, for example GPA, or familiarity with online course work, or strength of critical thinking. This oversight makes somewhat uncertain our finding that participation in online assignments is linked to student learning and student satisfaction. The missing pre-course measures could perhaps have generated other variables explaining any link.

A. Measures.

Both objective and subjective measures were used to indicate student learning or academic achievement. Performance on the course's comprehensive, online final exam provided the objective measure. It posed 2 essay questions and 1 optional bonus question. They were intended to evaluate students' understanding of concepts and theories explored in the course and to gauge students' ability to apply these concepts and theories in new contexts. Grading of the final exam took into account the student's choice to attempt or decline the bonus question.

Perceived student learning was indicated by students' subjective perceptions of how useful a given instructional activity had been to their learning. Two questions measured subjective perceptions for each online assignment, the chapter exams, the survey questions, the video questions, and online discussions. Students were asked how effectively each of these had commanded their attention and how effectively each had prompted both deep thinking about the material and application of the material in other contexts. Response categories for the 2 questions were 1 (*not at all*), 2 (*to a small extent*), 3 (*to some extent*), 4 (*to a moderate extent*), 5 (*to a great*

extent), and 6 (*to a very great extent*). For each question, a higher-numbered response indicated greater learning perceived by the student.

We calculated a score for each student's participation in, and degree of accuracy in completing, each online assignment. This score was obtained by summing points awarded for the 14 chapter exams (7.5 points possible per exam), 14 video questions (6 points possible per question), 14 survey questions (6 points possible per question), and 2 discussions (12 points possible per discussion). Two measures of student satisfaction were used that allowed comparison of student satisfaction with online assignments to student satisfaction with take-home assignments like those in their traditional courses. Students were asked the extent to which assignments captured their interest and the extent to which assignments increased their deep thinking, versus traditional take-home assignments' capacity to increase it. Available responses were 1 (*Online assignments are worse than traditional assignments*), 2 (*Online assignments are slightly worse than traditional assignments*), 3 (*Online assignments and traditional assignments are similar*), 4 (*Online assignments are slightly better than traditional assignments*), and 5 (*Online assignments are better than traditional assignments*). For each question, a higher-numbered response indicated greater student satisfaction with online assignments.

IV. Results.

Simple statistics describing all variables included in the study are reflected in Table 1, which illustrates the high levels of student satisfaction and student learning characterizing this sample. The average grade of 93.7% on the final exam was very high; its objective measure was accompanied by 8 subjective measures, namely respondents' ratings of each online assignment. Each student in the sample reported that each assignment captured interest and increased deep thinking at least to some extent.

Compared to their rating for traditional course assignments, the sample rated online assignments high, on average, for the assignments' capacity to command attention (4.2 out of 5 possible) and increase deep thinking (4.13 out of 5 possible). The high numbers suggest students in the sample were highly satisfied with the use of online assignments in this course. The study measured student participation in each type of online assignment by summing the number of points each student was awarded for assignments across the semester, to obtain the following results on average: survey questions, 71.1 (out of 84 possible); video questions, 65.7 (out of 84 possible); chapter exams, 76.9 (out of 112.5 possible); and online discussions, 18.8 (out of 24 possible). These totals appear reasonable for a general education course.

Because strong correlations existed among the variables of participation in online assignments and among perceived learning linked to different online assignments, we used bivariate regression analyses to explain student learning. These were able to capture effects of each participation variable on each student satisfaction variable and student learning variable, at the same time suggesting the impact of student satisfaction on student learning. As Table 2 shows, each time students participated in an online assignment designed to develop problem solving and critical thinking, their final exam scores increased significantly.

As for subjective measures of student learning, we examined correspondences of (a) participation in a given assignment to (b) perceived learning linked by students to that same assignment. We observed that, when students participated actively or fully in responding to video questions, completing chapter exams, and pursuing online discussions, the ratings they assigned to these activities (reflecting the activities' capacity to capture interest and prompt deep

Table 1. Descriptive Statistics of All Included Variables.

Included Variables	Mean	S.D.	N
Student Learning			
Final Exam	93.69	9.31	110
Survey Questions Capture Attention	3.47	1.41	90
Survey Questions Increase Deep Thinking	3.65	1.43	90
Video Questions Capture Attention	4.20	1.29	90
Video Questions Increase Deep Thinking	4.07	1.34	90
Chapter Exams Capture Attention	4.38	1.27	90
Chapter Exams Increase Deep Thinking	3.97	1.37	90
Online Discussions Capture Attention	3.89	1.33	90
Online Discussions Increase Deep Thinking	3.74	1.34	90
Student Satisfaction			
Satisfied with Online Assignments' Capacity to Command Attention	4.20	0.99	90
Satisfied with Online Assignments' Capacity to Increase Deep Thinking	4.13	1.04	90
Participation in Online Assignments			
Final Scores for Survey Questions	71.11	13.61	114
Final Scores for Video Questions	65.71	18.71	114
Final Scores for Chapter Exams	76.92	16.99	114
Final Scores for Online Discussions	18.82	7.48	114

thinking) rose significantly (see Table 2). In contrast, no statistically significant results were found for the survey question about online assignments. While this study measured a high level of student satisfaction with online assignments generally, only two kinds of assignment—video questions and online discussions—generated significant increases in student satisfaction with online assignments' capacity to prompt deep thinking. Moreover, only video questions generated a significant effect on student satisfaction with online assignments' capacity to command their attention. The statistically significant relationship found between online discussions and student satisfaction indicates that interacting online—replying to and/or challenging classmates' answers—may enhance student satisfaction with online learning.

Table 3 presents measures for the 2 student satisfaction variables in relation to the objective *and* subjective measures of student learning. The data make clear that these variables' association with student learning was insignificant when student learning was measured objectively. In contrast, when student learning was measured subjectively, both variables did significantly affect student learning. Students rating the online assignments as better than traditional assignments at commanding attention and increasing deep thinking were relatively likely to report that all four assignment types captured their attention and increased their deep thinking.

Table 2. Bivariate Regression Results for Student Learning and Student Satisfaction.

Participation in Online Assignments as a Predictor					
Dependent Variables	Participation in Online Assignments				N
	Survey b coeff.	Video b coeff.	Exam b coeff.	Discus sion	
Student Learning					
Final Exam	0.19*	0.13**	0.16**	0.34**	110
Survey Questions Capture Attention	0.02				90
Survey Questions Increase Deep Thinking	0.02				90
Video Questions Capture Attention		0.02**			90
Video Questions Increase Deep Thinking		0.02*			90
Chapter Exams Capture Attention			0.03**		90
Chapter Exams Increase Deep Thinking			0.02*		90
Online Discussions Capture Attention				0.05**	90
Online Discussions Increase Deep Thinking				0.04*	90
Student Satisfaction					
Satisfied with Online Assignments' Capacity to Command Attention	0.01	0.02**	0.01	0.02	90
Satisfied with Online Assignments' Capacity to Increase Deep Thinking	0.01	0.02*	0.01	0.03*	90
* p < .05 ** p < .01					

* p < .05 ** p < .01

Table 3. Bivariate Regression Results for Student Learning — Student Satisfaction Variables as Predictors.

Dependent Variables	Student Satisfaction Variables			
	Satisfaction with Online Assignments'		Capacity to Increase Deep Thinking	
	b Coeff.	N	b Coeff.	N
Student Learning				
Final Exam	-0.240	89	-0.780	89
Survey Questions Capture Attention	0.49**	90	0.43**	90
Survey Questions Increase Deep Thinking	0.51**	90	0.45**	90
Video Questions Capture Attention	0.46**	90	0.29*	90
Video Questions Increase Deep Thinking	0.5**	90	0.38**	90
Chapter Exams Capture Attention	0.41**	90	0.41**	90
Chapter Exams Increase Deep Thinking	0.58**	90	0.5**	90
Online Discussions Capture Attention	0.44**	90	0.43**	90
Online Discussions Increase Deep Thinking	0.38**	90	0.4**	90

* $p < .05$ ** $p < .01$

V. Discussion.

Using data collected from enrollees in 2 sections of a hybrid-format general education course offered in spring 2009, the present study examined whether having college students participate in online assignments enhances student satisfaction and student learning. The study also evaluated relationships between student satisfaction with online assignments and student learning. Several student learning variables measured both objectively and subjectively were used to indicate the enrollees' level of critical thinking. Overall, the study results confirmed that involving students in a series of online assignments can be important for increasing (a) their favorable attitudes toward online assignments versus traditional assignments and (b) degree of student learning, measured both objectively and subjectively. We used bivariate regression techniques in this study, examining relationships between student satisfaction, student learning, and participation in online assignments. However, there were no controls on pre-course measures that also could have explained student learning and student satisfaction. Future research should be sure to measure and control pre-course variables, employing multivariate data analysis techniques to better understand the relationships.

In the present study, student learning was indicated by an objective measure constructed to indicate students' critical thinking and by subjective measures of the extent to which enrollees' interest was captured and their deep thinking elicited. Mastery of a course's content is an important learning outcome, but development of high-order thinking is instrumental to students becoming lifelong learners and to their establishing personal criteria for their future ethical and intellectual judgments (Schneider, 2003). Having students participate in frequent work applying theories and concepts to novel questions and problems and/or requiring responses in essay format was shown in this study to be linked to higher achievement measured by a comprehensive final exam.

To supplement its objective measure of student learning, the present study used subjective measures indicating students' perceptions of whether given online assignments

actually piqued their interest to the point they undertook deep thinking. Students' perceptions about their reaching a deep-thinking stage may be affected, however, if critical thinking is too abstract a notion to be captured fully by objective measures. Consistent with previous studies, our results confirmed a relationship between student performance and online assignments, especially assignments accompanied by prompt formative assessment (Charman & Elmes, 1998; Sly & Rennie, 1999). In this study, three types of online assignment—video questions, chapter exams, and threaded discussions—were significantly associated with increased student learning, measured subjectively in students' perceptions. One type showed no such association—survey questions. The insignificant results obtained for survey questions may have arisen from a specific theme that characterized questions all semester: Hurricane Katrina. (The theme was chosen by the course instructor.) A typical survey question required responding to a magazine article. Specific topics of articles differed, but the presence of the Katrina theme throughout made some students comment that they felt they were writing on the same ideas repeatedly. It is possible, clearly, that lack of enthusiasm or lack of interest may affect students' interpretations of the learning achieved through an assignment.

Satisfaction measured among the present study's respondents was high, in terms of the use of online assignments instead of more traditional assignments. Their satisfaction, however, was not linked equally to all four types of engagement (i.e., with survey questions, with online questions, with threaded discussions, with chapter exams). It appears from the results that student participation in video questions and threaded discussions is most closely linked to satisfaction with online assignments. Any links between participation in survey questions or chapter exams and high student satisfaction were statistically insignificant. The literature reports that students' learning styles, personalities, and technological expertise are relevant to their success in an online environment (Meyer, 2003b; Rovai, 2004). Since college students today generally come from the Millennial generation, building a course around online assignments plays into their existing favorable attitudes about the online environment (Oblinger, 2003).

In this study, student satisfaction is thus partly a reflection of students' participation in online assignments; satisfaction was also observed here to be related to student learning, consistent with previous studies (Arbaugh, 2001; Hiltx, 1993; Rodriguez, et al., 1996). Significant predictive power of student satisfaction variables was limited, however, to those analyses involving our subjective measures of learning. Furthermore, the barely varying high scores on the final exam may have contributed somewhat to the objective measure's insignificant results, where student satisfaction variables also varied little. That we found quite significant results for perceived learning—measured *either* way—as an explanation of student satisfaction indicates the importance of having students participate in appropriate learning activities that stimulate interest and satisfaction, promoting critical thinking.

Instructors are responsible for creating the learning environment that cultivates problem solving and critical thinking, and doing so with shrinking resources. They must thus be knowledgeable of evidence-based pedagogical techniques capable of increasing teaching presence, social presence, and cognitive presence—while incurring little economic cost (Hannafin & Land, 1997). Their nature keeps hybrid courses cost-efficient, and using well-thought-out activities online can produce teaching presence, presence augmented by a hybrid course's simultaneous use of face-to-face learning (Dziuban & Moskal, 2001). And as the literature suggests, online study's minimization of the time factor enhances cognitive presence, freeing students to reflect, while its capacity to enhance social presence is seen in electronic

communication like threaded discussions, in which all participants have equitable roles (Garrison, et al., 2001; Meyer, 2003a; Picciano, 2002; Wise, Chang, Duffy, & Del Valle, 2004).

Several limitations on the study must be mentioned. First, its small sample precluded truly sophisticated multivariate data analyses that might elaborate on *how* being engaged in online work leads to student satisfaction and student learning. On the other hand, the rich data we collected describing student learning are a unique contribution. Second, the measures used in the present study were not the ideal for experimental study. For instance, while participation in online assignments could be usefully measured via students' total scores on online assignments, we did not compare said participation with the students' participation in traditional assignments. In addition, in drafting survey items used to measure subjective perceptions of learning and satisfaction with online assignments, we made the assumption that the surveyed students comprehended the concept *deep learning*. We do not know how well-founded this assumption was.

Third, our cross-sectional survey design may not be suitable for affirming temporal order, and for purposes of the study we assumed that participation in online assignments affected student satisfaction, which in turn stimulated student learning. Future studies should involve a true experimental study or a longitudinal design. They should furthermore move beyond theoretical affirmation of the three variables' relationships.

Finally, future studies should include factors such as existing knowledge, learning styles, and personalities—proven relevant to student learning among college students today—in order to further our understanding of student participation and student learning in higher education. All in all, the present study's results clearly confirm the contribution a carefully designed series of online assignments can make to students' satisfaction and learning in a general education course.

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